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Séminaire de Physique Nucléaire Théorique

Towards Determining the Short-Range Contribution to Neutrinoless Double-Beta Decay Through Pion-Nucleus Reactions

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The unknown short-range contribution to neutrinoless double-beta decay ($0\nu\beta\beta$) was found to be related to two electromagnetic isospin breaking operators, which would contribute to charge independence breaking (CIB) in nuclear systems and pion-nucleus reactions. To determine such short-range contribution, we construct different CIB quantities from pion-nucleus reactions. By considering elastic scattering between pions and fictitious two-nucleon systems in the $^1S_0$ channel, we calculate one of these CIB quantities and resolve the corresponding renormalization problem. Two short-range operators are found to be necessary at leading-order to ensure renormalizability. It is shown that the renormalization in pion-nucleus scattering is consistent with that in $0\nu\beta\beta$. As a proof of principle, we demonstrate that the short-range contribution to $0\nu\beta\beta$ could be determined from pion-nucleus reactions. To eventually fix the short-range contribution, experimental inputs from pion-nucleus reactions and solid many-body calculations are needed.

Jeudi 17 Octobre 2024
14 :00
IJCLab, Bât. 100, Salle Room A201